

SEQUENCE LISTING

<110> Kirin Beer Kabushiki Kaisha; Japan International Research Center for Agricultural Sciences

<120> A production of plants having improved rooting efficiency and vase life by using environmental stress-resistant gene

<130> PH-2034

<150> JP 2003-071082

<151> 2003-03-14

<160> 30

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<212> DNA

<213> Arabidopsis thaliana

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<221> CDS

<222> (119).. (766)

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Met Asn Ser Phe Ser Ala Phe Ser Glu Met Phe Gly Ser Asp Tyr Glu
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Ser Ser Val Ser Ser Gly Gly Asp Tyr Ile Pro Thr Leu Ala Ser Ser	
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tgc ccc aag aaa ccg gcg ggt cgt aag aag ttt cgt gag act cgt cac	262
Cys Pro Lys Lys Pro Ala Gly Arg Lys Lys Phe Arg Glu Thr Arg His	
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cca ata tac aga gga gtt cgt cgg aga aac tcc ggt aag tgg gtt tgt	310
Pro Ile Tyr Arg Gly Val Arg Arg Arg Asn Ser Gly Lys Trp Val Cys	
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gag gtt aga gaa cca aac aag aaa aca agg att tgg ctc gga aca ttt	358
Glu Val Arg Glu Pro Asn Lys Lys Thr Arg Ile Trp Leu Gly Thr Phe	
65 70 75 80	
caa acc gct gag atg gca gct cga gct cac gac gtt gcc gct tta gcc	406
Gln Thr Ala Glu Met Ala Ala Arg Ala His Asp Val Ala Ala Leu Ala	
85 90 95	
ctt cgt ggc cga tca gcc tgt ctc aat ttc gct gac tcg gct tgg aga	454
Leu Arg Gly Arg Ser Ala Cys Leu Asn Phe Ala Asp Ser Ala Trp Arg	
100 105 110	
ctc cga atc ccg gaa tca act tgc gct aag gac atc caa aag gcg gcg	502
Leu Arg Ile Pro Glu Ser Thr Cys Ala Lys Asp Ile Gln Lys Ala Ala	
115 120 125	
gct gaa gct gcg ttg gcg ttt cag gat gag atg tgt gat gcg acg acg	550
Ala Glu Ala Ala Leu Ala Phe Gln Asp Glu Met Cys Asp Ala Thr Thr	
130 135 140	
gat cat ggc ttc gac atg gag gag acg ttg gtg gag gct att tac acg	598
Asp His Gly Phe Asp Met Glu Glu Thr Leu Val Glu Ala Ile Tyr Thr	
145 150 155 160	
gcg gaa cag agc gaa aat gcg ttt tat atg cac gat gag gcg atg ttt	646
Ala Glu Gln Ser Glu Asn Ala Phe Tyr Met His Asp Glu Ala Met Phe	
165 170 175	
gag atg ccg agt ttg ttg gct aat atg gca gaa ggg atg ctt ttg ccg	694

Glu Met Pro Ser Leu Leu Ala Asn Met Ala Glu Gly Met Leu Leu Pro	
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ctt ccg tcc gta cag tgg aat cat aat cat gaa gtc gac ggc gat gat	742
Leu Pro Ser Val Gln Trp Asn His Asn His Glu Val Asp Gly Asp Asp	
195 200 205	
gac gac gta tcg tta tgg agt tat taaaactcag attattattt ccatttttag	796
Asp Asp Val Ser Leu Trp Ser Tyr	
210 215	
tacgatactt tttattttat tattattttt agatcctttt ttagaatgga atcttcatta	856
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Pro Ile Tyr Arg Gly Val Arg Arg Arg Asn Ser Gly Lys Trp Val Cys	
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Glu Val Arg Glu Pro Asn Lys Lys Thr Arg Ile Trp Leu Gly Thr Phe	
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Gln Thr Ala Glu Met Ala Ala Arg Ala His Asp Val Ala Ala Leu Ala	
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Leu	Arg	Gly	Arg	Ser	Ala	Cys	Leu	Asn	Phe	Ala	Asp	Ser	Ala	Trp	Arg
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Leu	Arg	Ile	Pro	Glu	Ser	Thr	Cys	Ala	Lys	Asp	Ile	Gln	Lys	Ala	Ala
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Asp	His	Gly	Phe	Asp	Met	Glu	Glu	Thr	Leu	Val	Glu	Ala	Ile	Tyr	Thr
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Ala	Glu	Gln	Ser	Glu	Asn	Ala	Phe	Tyr	Met	His	Asp	Glu	Ala	Met	Phe
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Leu	Pro	Ser	Val	Gln	Trp	Asn	His	Asn	His	Glu	Val	Asp	Gly	Asp	Asp
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<222> (167).. (1171)

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				Met	Ala	Val

tat gat cag agt gga gat aga aac aga aca caa att gat aca tcg agg	223
Tyr Asp Gln Ser Gly Asp Arg Asn Arg Thr Gln Ile Asp Thr Ser Arg	
5 10 15	
aaa agg aaa tct aga agt aga ggt gac ggt act act gtg gct gag aga	271
Lys Arg Lys Ser Arg Ser Arg Gly Asp Gly Thr Thr Val Ala Glu Arg	
20 25 30 35	
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Leu Lys Arg Trp Lys Glu Tyr Asn Glu Thr Val Glu Glu Val Ser Thr	
40 45 50	
aag aag agg aaa gta cct gcg aaa ggg tcg aag aag ggt tgt atg aaa	367
Lys Lys Arg Lys Val Pro Ala Lys Gly Ser Lys Lys Gly Cys Met Lys	
55 60 65	
ggt aaa gga gga cca gag aat agc cga tgt agt ttc aga gga gtt agg	415
Gly Lys Gly Gly Pro Glu Asn Ser Arg Cys Ser Phe Arg Gly Val Arg	
70 75 80	
caa agg att tgg ggt aaa tgg gtt gct gag atc aga gag cct aat cga	463
Gln Arg Ile Trp Gly Lys Trp Val Ala Glu Ile Arg Glu Pro Asn Arg	
85 90 95	
ggt agc agg ctt tgg ctt ggt act ttc cct act gct caa gaa gct gct	511
Gly Ser Arg Leu Trp Leu Gly Thr Phe Pro Thr Ala Gln Glu Ala Ala	
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Leu Asn Phe Pro Arg Ser Asp Ala Ser Glu Val Thr Ser Thr Ser Ser	
135 140 145	
cag tct gag gtg tgt act gtt gag act cct ggt tgt gtt cat gtg aaa	655
Gln Ser Glu Val Cys Thr Val Glu Thr Pro Gly Cys Val His Val Lys	

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Thr Glu Asp Pro Asp Cys Glu Ser Lys Pro Phe Ser Gly Gly Val Glu			
165	170	175	
ccg atg tat tgt ctg gag aat ggt gcg gaa gag atg aag aga ggt gtt			751
Pro Met Tyr Cys Leu Glu Asn Gly Ala Glu Glu Met Lys Arg Gly Val			
180	185	190	195
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Lys Ala Asp Lys His Trp Leu Ser Glu Phe Glu His Asn Tyr Trp Ser			
200	205	210	
gat att ctg aaa gag aaa gag aaa cag aag gag caa ggg att gta gaa			847
Asp Ile Leu Lys Glu Lys Glu Lys Gln Lys Glu Gln Gly Ile Val Glu			
215	220	225	
acc tgt cag caa caa cag cag gat tcg cta tct gtt gca gac tat ggt			895
Thr Cys Gln Gln Gln Gln Gln Asp Ser Leu Ser Val Ala Asp Tyr Gly			
230	235	240	
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Trp Pro Asn Asp Val Asp Gln Ser His Leu Asp Ser Ser Asp Met Phe			
245	250	255	
gat gtc gat gag ctt cta cgt gac cta aat ggc gac gat gtg ttt gca			991
Asp Val Asp Glu Leu Leu Arg Asp Leu Asn Gly Asp Asp Val Phe Ala			
260	265	270	275
ggc tta aat cag gac cgg tac ccg ggg aac agt gtt gcc aac ggt tca			1039
Gly Leu Asn Gln Asp Arg Tyr Pro Gly Asn Ser Val Ala Asn Gly Ser			
280	285	290	
tac agg ccc gag agt caa caa agt ggt ttt gat ccg cta caa agc ctc			1087
Tyr Arg Pro Glu Ser Gln Gln Ser Gly Phe Asp Pro Leu Gln Ser Leu			
295	300	305	
aac tac gga ata cct ccg ttt cag ctc gag gga aag gat ggt aat gga			1135
Asn Tyr Gly Ile Pro Pro Phe Gln Leu Glu Gly Lys Asp Gly Asn Gly			

310	315	320	
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Phe Phe Asp Asp Leu Ser Tyr Leu Asp Leu Glu Asn			
325	330	335	
aatatgaagc tttttggatt tgatatttgc cttaatccca caacgactgt tgattctcta			1241
tccgagtttt agtgatatag agaactacag aacacgtttt ttcttgttat aaaggatgaac			1301
tgtatataatc gaaacagtga tatgacaata gagaagacaa ctatagtttg ttagtctgct			1361
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 <212> PRT
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Cys Met Lys Gly Lys Gly Gly Pro Glu Asn Ser Arg Cys Ser Phe Arg			
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Gly Val Arg Gln Arg Ile Trp Gly Lys Trp Val Ala Glu Ile Arg Glu			
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Pro Asn Arg Gly Ser Arg Leu Trp Leu Gly Thr Phe Pro Thr Ala Gln			
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Leu	Ala	Arg	Leu	Asn	Phe	Pro	Arg	Ser	Asp	Ala	Ser	Glu	Val	Thr	Ser
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195				200				205							
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210				215				220							
Ile	Val	Glu	Thr	Cys	Gln	Gln	Gln	Gln	Gln	Asp	Ser	Leu	Ser	Val	Ala
225				230				235				240			
Asp	Tyr	Gly	Trp	Pro	Asn	Asp	Val	Asp	Gln	Ser	His	Leu	Asp	Ser	Ser
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260				265				270							
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275				280				285							
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290				295				300							
Gln	Ser	Leu	Asn	Tyr	Gly	Ile	Pro	Pro	Phe	Gln	Leu	Glu	Gly	Lys	Asp
305				310				315				320			
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<222> (164).. (802)

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Met Asn Ser Phe

1

tca gct ttt tct gaa atg ttt ggc tcc gat tac gag cct caa ggc gga 223
Ser Ala Phe Ser Glu Met Phe Gly Ser Asp Tyr Glu Pro Gln Gly Gly
5 10 15 20

gat tat tgt ccg acg ttg gcc acg agt tgt ccg aag aaa ccg gcg ggc 271
Asp Tyr Cys Pro Thr Leu Ala Thr Ser Cys Pro Lys Lys Pro Ala Gly
25 30 35

cgt aag aag ttt cgt gag act cgt cac cca att tac aga gga gtt cgt 319
Arg Lys Lys Phe Arg Glu Thr Arg His Pro Ile Tyr Arg Gly Val Arg
40 45 50

caa aga aac tcc ggt aag tgg gtt tct gaa gtg aga gag cca aac aag 367
Gln Arg Asn Ser Gly Lys Trp Val Ser Glu Val Arg Glu Pro Asn Lys
55 60 65

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Lys Thr Arg Ile Trp Leu Gly Thr Phe Gln Thr Ala Glu Met Ala Ala
70 75 80

cgt gct cac gac gtc gct gca tta gcc ctc cgt ggc cga tca gca tgt	463
Arg Ala His Asp Val Ala Ala Leu Ala Leu Arg Gly Arg Ser Ala Cys	
85 90 95 100	
ctc aac ttc gct gac tcg gct tgg cgg cta cga atc ccg gag tca aca	511
Leu Asn Phe Ala Asp Ser Ala Trp Arg Leu Arg Ile Pro Glu Ser Thr	
105 110 115	
tgc gcc aag gat atc caa aaa gcg gct gct gaa gcg gcg ttg gct ttt	559
Cys Ala Lys Asp Ile Gln Lys Ala Ala Ala Glu Ala Ala Leu Ala Phe	
120 125 130	
caa gat gag acg tgt gat acg acg acc acg aat cat ggc ctg gac atg	607
Gln Asp Glu Thr Cys Asp Thr Thr Thr Thr Asn His Gly Leu Asp Met	
135 140 145	
gag gag acg atg gtg gaa gct att tat aca ccg gaa cag agc gaa ggt	655
Glu Glu Thr Met Val Glu Ala Ile Tyr Thr Pro Glu Gln Ser Glu Gly	
150 155 160	
gcg ttt tat atg gat gag gag aca atg ttt ggg atg ccg act ttg ttg	703
Ala Phe Tyr Met Asp Glu Glu Thr Met Phe Gly Met Pro Thr Leu Leu	
165 170 175 180	
gat aat atg gct gaa ggc atg ctt tta ccg ccg ccg tct gtt caa tgg	751
Asp Asn Met Ala Glu Gly Met Leu Leu Pro Pro Pro Ser Val Gln Trp	
185 190 195	
aat cat aat tat gac ggc gaa gga gat ggt gac gtg tcg ctt tgg agt	799
Asn His Asn Tyr Asp Gly Glu Gly Asp Gly Asp Val Ser Leu Trp Ser	
200 205 210	
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Tyr	
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<213> *Arabidopsis thaliana*

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Lys	Pro	Ala	Gly	Arg	Lys	Lys	Phe	Arg	Glu	Thr	Arg	His	Pro	Ile	Tyr
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Arg	Gly	Val	Arg	Gln	Arg	Asn	Ser	Gly	Lys	Trp	Val	Ser	Glu	Val	Arg
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Pro	Glu	Ser	Thr	Cys	Ala	Lys	Asp	Ile	Gln	Lys	Ala	Ala	Ala	Glu	Ala
		115						120					125		
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Gln	Ser	Glu	Gly	Ala	Phe	Tyr	Met	Asp	Glu	Glu	Thr	Met	Phe	Gly	Met
			165						170					175	
Pro	Thr	Leu	Leu	Asp	Asn	Met	Ala	Glu	Gly	Met	Leu	Leu	Pro	Pro	Pro
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Ser Leu Trp Ser Tyr
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200

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<220>
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<222> (135).. (782)

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          Met Asn Ser Phe Ser Ala Phe Ser Glu Met Phe Gly
              1             5             10
tcc gat tac gag tct ccg gtt tcc tca ggc ggt gat tac agt ccg aag 218
Ser Asp Tyr Glu Ser Pro Val Ser Ser Gly Gly Asp Tyr Ser Pro Lys
          15             20             25
ctt gcc acg agc tgc ccc aag aaa cca gcg gga agg aag aag ttt cgt 266
Leu Ala Thr Ser Cys Pro Lys Lys Pro Ala Gly Arg Lys Lys Phe Arg
          30             35             40
gag act cgt cac cca att tac aga gga gtt cgt caa aga aac tcc ggt 314
Glu Thr Arg His Pro Ile Tyr Arg Gly Val Arg Gln Arg Asn Ser Gly
          45             50             55             60
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Lys Trp Val Cys Glu Leu Arg Glu Pro Asn Lys Lys Thr Arg Ile Trp
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	80	85	90	
gcc gcc ata gct ctc cgt ggc aga tct gcc tgt ctc aat ttc gct gac				458
Ala Ala Ile Ala Leu Arg Gly Arg Ser Ala Cys Leu Asn Phe Ala Asp				
	95	100	105	
tcg gct tgg cgg cta cga atc ccg gaa tca acc tgt gcc aag gaa atc				506
Ser Ala Trp Arg Leu Arg Ile Pro Glu Ser Thr Cys Ala Lys Glu Ile				
	110	115	120	
caa aag gcg gcg gct gaa gcc gcg ttg aat ttt caa gat gag atg tgt				554
Gln Lys Ala Ala Ala Glu Ala Ala Leu Asn Phe Gln Asp Glu Met Cys				
	125	130	135	140
cat atg acg acg gat gct cat ggt ctt gac atg gag gag acc ttg gtg				602
His Met Thr Thr Asp Ala His Gly Leu Asp Met Glu Glu Thr Leu Val				
	145	150	155	
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Glu Ala Ile Tyr Thr Pro Glu Gln Ser Gln Asp Ala Phe Tyr Met Asp				
	160	165	170	
gaa gag gcg atg ttg ggg atg tct agt ttg ttg gat aac atg gcc gaa				698
Glu Glu Ala Met Leu Gly Met Ser Ser Leu Leu Asp Asn Met Ala Glu				
	175	180	185	
ggg atg ctt tta ccg tcg ccg tcg gtt caa tgg aac tat aat ttt gat				746
Gly Met Leu Leu Pro Ser Pro Ser Val Gln Trp Asn Tyr Asn Phe Asp				
	190	195	200	
gtc gag gga gat gat gac gtg tcc tta tgg agc tat taaaattcga				792
Val Glu Gly Asp Asp Asp Val Ser Leu Trp Ser Tyr				
	205	210	215	
tttttatttc catttttgggt attatagctt ttatacatt tgatcctttt ttagaatgga				852
tcctcttctt tttttgggttg tgagaaacga atgtaaatgg taaaagtgt tgtcaaatgc				912

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944

<210> 8

<211> 216

<212> PRT

<213> Arabidopsis thaliana

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				20				25					30		
Cys	Pro	Lys	Lys	Pro	Ala	Gly	Arg	Lys	Lys	Phe	Arg	Glu	Thr	Arg	His
				35				40					45		
Pro	Ile	Tyr	Arg	Gly	Val	Arg	Gln	Arg	Asn	Ser	Gly	Lys	Trp	Val	Cys
	50					55					60				
Glu	Leu	Arg	Glu	Pro	Asn	Lys	Lys	Thr	Arg	Ile	Trp	Leu	Gly	Thr	Phe
65					70					75				80	
Gln	Thr	Ala	Glu	Met	Ala	Ala	Arg	Ala	His	Asp	Val	Ala	Ala	Ile	Ala
				85					90					95	
Leu	Arg	Gly	Arg	Ser	Ala	Cys	Leu	Asn	Phe	Ala	Asp	Ser	Ala	Trp	Arg
				100				105					110		
Leu	Arg	Ile	Pro	Glu	Ser	Thr	Cys	Ala	Lys	Glu	Ile	Gln	Lys	Ala	Ala
				115				120					125		
Ala	Glu	Ala	Ala	Leu	Asn	Phe	Gln	Asp	Glu	Met	Cys	His	Met	Thr	Thr
				130			135				140				
Asp	Ala	His	Gly	Leu	Asp	Met	Glu	Glu	Thr	Leu	Val	Glu	Ala	Ile	Tyr
145					150					155				160	
Thr	Pro	Glu	Gln	Ser	Gln	Asp	Ala	Phe	Tyr	Met	Asp	Glu	Glu	Ala	Met
				165					170					175	

Leu Gly Met Ser Ser Leu Leu Asp Asn Met Ala Glu Gly Met Leu Leu
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<222> (183).. (1172)

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 cgactctaata cctggagtta tcattcacga tagattctta gattgcgact ataaagaaga 180
 ag atg gct gta tat gaa caa acc gga acc gag cag ccg aag aaa agg 227
 Met Ala Val Tyr Glu Gln Thr Gly Thr Glu Gln Pro Lys Lys Arg
 1 5 10 15
 aaa tct agg gct cga gca ggt ggt tta acg gtg gct gat agg cta aag 275

Lys	Ser	Arg	Ala	Arg	Ala	Gly	Gly	Leu	Thr	Val	Ala	Asp	Arg	Leu	Lys	
aag	tgg	aaa	gag	tac	aac	gag	att	gtt	gaa	gct	tcg	gct	gtt	aaa	gaa	323
Lys	Trp	Lys	Glu	Tyr	Asn	Glu	Ile	Val	Glu	Ala	Ser	Ala	Val	Lys	Glu	
gga	gag	aaa	ccg	aaa	cgc	aaa	gtt	cct	gcg	aaa	ggg	tcg	aag	aaa	ggc	371
Gly	Glu	Lys	Pro	Lys	Arg	Lys	Val	Pro	Ala	Lys	Gly	Ser	Lys	Lys	Gly	
tgt	atg	aag	ggc	aaa	gga	gga	cca	gat	aat	tct	cac	tgt	agt	ttt	aga	419
Cys	Met	Lys	Gly	Lys	Gly	Gly	Pro	Asp	Asn	Ser	His	Cys	Ser	Phe	Arg	
gga	gtt	aga	caa	agg	att	tgg	ggc	aaa	tgg	gtt	gca	gag	att	cga	gaa	467
Gly	Val	Arg	Gln	Arg	Ile	Trp	Gly	Lys	Trp	Val	Ala	Glu	Ile	Arg	Glu	
ccg	aaa	ata	gga	act	aga	ctt	tgg	ctt	ggc	act	ttt	cct	acc	gcg	gaa	515
Pro	Lys	Ile	Gly	Thr	Arg	Leu	Trp	Leu	Gly	Thr	Phe	Pro	Thr	Ala	Glu	
aaa	gct	gct	tcc	gct	tat	gat	gaa	gcg	gct	acc	gct	atg	tac	ggc	tca	563
Lys	Ala	Ala	Ser	Ala	Tyr	Asp	Glu	Ala	Ala	Thr	Ala	Met	Tyr	Gly	Ser	
ttg	gct	cgt	ctt	aac	ttc	cct	cag	tct	gtt	ggg	tct	gag	ttt	act	agt	611
Leu	Ala	Arg	Leu	Asn	Phe	Pro	Gln	Ser	Val	Gly	Ser	Glu	Phe	Thr	Ser	
acg	tct	agt	caa	tct	gag	gtg	tgt	acg	gtt	gaa	aat	aag	gcg	gtt	gtt	659
Thr	Ser	Ser	Gln	Ser	Glu	Val	Cys	Thr	Val	Glu	Asn	Lys	Ala	Val	Val	
tgt	ggc	gat	gtt	tgt	gtg	aag	cat	gaa	gat	act	gat	tgt	gaa	tct	aat	707
Cys	Gly	Asp	Val	Cys	Val	Lys	His	Glu	Asp	Thr	Asp	Cys	Glu	Ser	Asn	
cca	ttt	agt	cag	att	tta	gat	gtt	aga	gaa	gag	tct	tgt	gga	acc	agg	755

Pro Phe Ser Gln Ile Leu Asp Val Arg Glu Glu Ser Cys Gly Thr Arg	
180	185
ccg gac agt tgc acg gtt gga cat caa gat atg aat tct tcg ctg aat	803
Pro Asp Ser Cys Thr Val Gly His Gln Asp Met Asn Ser Ser Leu Asn	
195	200
tac gat ttg ctg tta gag ttt gag cag cag tat tgg ggc caa gtt ttg	851
Tyr Asp Leu Leu Leu Glu Phe Glu Gln Gln Tyr Trp Gly Gln Val Leu	
210	215
cag gag aaa gag aaa ccg aag cag gaa gaa gag gag ata cag caa cag	899
Gln Glu Lys Glu Lys Pro Lys Gln Glu Glu Glu Glu Ile Gln Gln Gln	
225	230
caa cag gaa cag caa cag caa cag ctg caa ccg gat ttg ctt act gtt	947
Gln Gln Glu Gln Gln Gln Gln Gln Leu Gln Pro Asp Leu Leu Thr Val	
240	245
gca gat tac ggt tgg cct tgg tct aat gat att gta aat gat cag act	995
Ala Asp Tyr Gly Trp Pro Trp Ser Asn Asp Ile Val Asn Asp Gln Thr	
260	265
tct tgg gat cct aat gag tgc ttt gat att aat gaa ctc ctt gga gat	1043
Ser Trp Asp Pro Asn Glu Cys Phe Asp Ile Asn Glu Leu Leu Gly Asp	
275	280
ttg aat gaa cct ggt ccc cat cag agc caa gac caa aac cac gta aat	1091
Leu Asn Glu Pro Gly Pro His Gln Ser Gln Asp Gln Asn His Val Asn	
290	295
tct ggt agt tat gat ttg cat ccg ctt cat ctc gag cca cac gat ggt	1139
Ser Gly Ser Tyr Asp Leu His Pro Leu His Leu Glu Pro His Asp Gly	
305	310
cac gag ttc aat ggt ttg agt tct ctg gat att tgagagttct gaggcaatgg	1192
His Glu Phe Asn Gly Leu Ser Ser Leu Asp Ile	
320	325
tcctacaaga ctacaacata atctttggat tgatcatagg agaaacaaga aataggtggt	1252

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<210> 10

<211> 330

<212> PRT

<213> Arabidopsis thaliana

<400> 10

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Ser	Arg	Ala	Arg	Ala	Gly	Gly	Leu	Thr	Val	Ala	Asp	Arg	Leu	Lys	Lys
				20				25					30		
Trp	Lys	Glu	Tyr	Asn	Glu	Ile	Val	Glu	Ala	Ser	Ala	Val	Lys	Glu	Gly
				35				40					45		
Glu	Lys	Pro	Lys	Arg	Lys	Val	Pro	Ala	Lys	Gly	Ser	Lys	Lys	Gly	Cys
				50				55					60		
Met	Lys	Gly	Lys	Gly	Gly	Pro	Asp	Asn	Ser	His	Cys	Ser	Phe	Arg	Gly
65						70					75				80
Val	Arg	Gln	Arg	Ile	Trp	Gly	Lys	Trp	Val	Ala	Glu	Ile	Arg	Glu	Pro
				85				90					95		
Lys	Ile	Gly	Thr	Arg	Leu	Trp	Leu	Gly	Thr	Phe	Pro	Thr	Ala	Glu	Lys
				100				105					110		
Ala	Ala	Ser	Ala	Tyr	Asp	Glu	Ala	Ala	Thr	Ala	Met	Tyr	Gly	Ser	Leu
				115				120					125		
Ala	Arg	Leu	Asn	Phe	Pro	Gln	Ser	Val	Gly	Ser	Glu	Phe	Thr	Ser	Thr
				130				135					140		
Ser	Ser	Gln	Ser	Glu	Val	Cys	Thr	Val	Glu	Asn	Lys	Ala	Val	Val	Cys

145	150	155	160
Gly Asp Val Cys Val Lys His Glu Asp Thr Asp Cys Glu Ser Asn Pro			
	165	170	175
Phe Ser Gln Ile Leu Asp Val Arg Glu Glu Ser Cys Gly Thr Arg Pro			
	180	185	190
Asp Ser Cys Thr Val Gly His Gln Asp Met Asn Ser Ser Leu Asn Tyr			
	195	200	205
Asp Leu Leu Leu Glu Phe Glu Gln Gln Tyr Trp Gly Gln Val Leu Gln			
	210	215	220
Glu Lys Glu Lys Pro Lys Gln Glu Glu Glu Ile Gln Gln Gln Gln			
	225	230	235
Gln Glu Gln Gln Gln Gln Gln Leu Gln Pro Asp Leu Leu Thr Val Ala			
	245	250	255
Asp Tyr Gly Trp Pro Trp Ser Asn Asp Ile Val Asn Asp Gln Thr Ser			
	260	265	270
Trp Asp Pro Asn Glu Cys Phe Asp Ile Asn Glu Leu Leu Gly Asp Leu			
	275	280	285
Asn Glu Pro Gly Pro His Gln Ser Gln Asp Gln Asn His Val Asn Ser			
	290	295	300
Gly Ser Tyr Asp Leu His Pro Leu His Leu Glu Pro His Asp Gly His			
	305	310	315
Glu Phe Asn Gly Leu Ser Ser Leu Asp Ile			
	325	330	

<210> 11

<211> 675

<212> DNA

<213> Arabidopsis thaliana

<400> 11

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 gctgggagga agaagtttcg tgagacacgt catccgattt acagaggagt tcgtcagagg 180
 aattctggta aatgggtttg tgaagttaga gaggcctaata agaaatctag gatttggtta 240
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 cgtggctgct ctgcttgtct caatttcgct gattctgctt ggccggcttcg tattcctgag 360
 actacttgct ctaaggagat tcagaaagct gcgtctgaag ctgcaatggc gtttcagaat 420
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 gaggcgcitt tggggatgcc caactttttt gagaatatgg cggaggggat gcttttgccg 600
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<210> 12

<211> 224

<212> PRT

<213> *Arabidopsis thaliana*

<400> 12

Met	Asn	Pro	Phe	Tyr	Ser	Thr	Phe	Pro	Asp	Ser	Phe	Leu	Ser	Ile	Ser
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Asp	His	Arg	Ser	Pro	Val	Ser	Asp	Ser	Ser	Glu	Cys	Ser	Pro	Lys	Leu
			20					25					30		

Ala	Ser	Ser	Cys	Pro	Lys	Lys	Arg	Ala	Gly	Arg	Lys	Lys	Phe	Arg	Glu
			35				40						45		

Thr	Arg	His	Pro	Ile	Tyr	Arg	Gly	Val	Arg	Gln	Arg	Asn	Ser	Gly	Lys
			50				55					60			

Trp Val Cys Glu Val Arg Glu Pro Asn Lys Lys Ser Arg Ile Trp Leu
65 70 75 80

Gly Thr Phe Pro Thr Val Glu Met Ala Ala Arg Ala His Asp Val Ala
85 90 95

Ala Leu Ala Leu Arg Gly Arg Ser Ala Cys Leu Asn Phe Ala Asp Ser
100 105 110

Ala Trp Arg Leu Arg Ile Pro Glu Thr Thr Cys Pro Lys Glu Ile Gln
115 120 125

Lys Ala Ala Ser Glu Ala Ala Met Ala Phe Gln Asn Glu Thr Thr Thr
130 135 140

Glu Gly Ser Lys Thr Ala Ala Glu Ala Glu Glu Ala Ala Gly Glu Gly
145 150 155 160

Val Arg Glu Gly Glu Arg Arg Ala Glu Glu Gln Asn Gly Gly Val Phe
165 170 175

Tyr Met Asp Asp Glu Ala Leu Leu Gly Met Pro Asn Phe Phe Glu Asn
180 185 190

Met Ala Glu Gly Met Leu Leu Pro Pro Pro Glu Val Gly Trp Asn His
195 200 205

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210 215 220

<210> 13

<211> 546

<212> DNA

<213> *Arabidopsis thaliana*

<400> 13

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tgggtatgcg aagtcctga accgattcat cagcgtcgag tctggctcgg aacttatccg 180
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gacacgatca ggcgcacggc ggccgaagca gcggagatgt tcaggccgcc ggagtttagt 360
acaggaatta cggttttacc ctcagccagt gagtttgaca cgtcggatga aggagtcgct 420
ggaatgatga tgaggctcgc ggaggagccg ttgatgtcgc cgccaagatc gtacattgat 480
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tactaa 546
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<210> 14

<211> 181

<212> PRT

<213> *Arabidopsis thaliana*

<400> 14

Met Glu Asn Asp Asp Ile Thr Val Ala Glu Met Lys Pro Lys Lys Arg

1

5

10

15

Ala Gly Arg Arg Ile Phe Lys Glu Thr Arg His Pro Ile Tyr Arg Gly

20

25

30

Val Arg Arg Arg Asp Gly Asp Lys Trp Val Cys Glu Val Arg Glu Pro
35 40 45

Ile His Gln Arg Arg Val Trp Leu Gly Thr Tyr Pro Thr Ala Asp Met
50 55 60

Ala Ala Arg Ala His Asp Val Ala Val Leu Ala Leu Arg Gly Arg Ser
65 70 75 80

Ala Cys Leu Asn Phe Ser Asp Ser Ala Trp Arg Leu Pro Val Pro Ala
85 90 95

Ser Thr Asp Pro Asp Thr Ile Arg Arg Thr Ala Ala Glu Ala Ala Glu
100 105 110

Met Phe Arg Pro Pro Glu Phe Ser Thr Gly Ile Thr Val Leu Pro Ser
115 120 125

Ala Ser Glu Phe Asp Thr Ser Asp Glu Gly Val Ala Gly Met Met Met
130 135 140

Arg Leu Ala Glu Glu Pro Leu Met Ser Pro Pro Arg Ser Tyr Ile Asp
145 150 155 160

Met Asn Thr Ser Val Tyr Val Asp Glu Glu Met Cys Tyr Glu Asp Leu
165 170 175

Ser Leu Trp Ser Tyr
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<210> 15

<211> 630

<212> DNA

<213> *Arabidopsis thaliana*

<400> 15

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gcatgtttga atttcgccga ctccgcttgg cggcttcggg tgccggaatc caatgatccg 300
gatgtgataa gaagagttgc ggcggaagct gcggagatgt ttaggccggt ggatttagaa 360
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tccggctctg gttcgggacg ggaggagagg aattcttctt cgtatggatt tggagactac 480
gaagaagtct caacgacgat gatgagactc gcggaggggc cactaatgtc gccgccgcga 540
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<211> 209

<212> PRT

<213> *Arabidopsis thaliana*

<400> 16

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Ala Gly Arg Arg Val Phe Lys Glu Thr Arg His Pro Val Tyr Arg Gly
      20             25             30

Ile Arg Arg Arg Asn Gly Asp Lys Trp Val Cys Glu Val Arg Glu Pro
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35

40

45

Thr His Gln Arg Arg Ile Trp Leu Gly Thr Tyr Pro Thr Ala Asp Met

50

55

60

Ala Ala Arg Ala His Asp Val Ala Val Leu Ala Leu Arg Gly Arg Ser

65

70

75

80

Ala Cys Leu Asn Phe Ala Asp Ser Ala Trp Arg Leu Pro Val Pro Glu

85

90

95

Ser Asn Asp Pro Asp Val Ile Arg Arg Val Ala Ala Glu Ala Ala Glu

100

105

110

Met Phe Arg Pro Val Asp Leu Glu Ser Gly Ile Thr Val Leu Pro Cys

115

120

125

Ala Gly Asp Asp Val Asp Leu Gly Phe Gly Ser Gly Ser Gly Ser Gly

130

135

140

Ser Gly Ser Glu Glu Arg Asn Ser Ser Ser Tyr Gly Phe Gly Asp Tyr

145

150

155

160

Glu Glu Val Ser Thr Thr Met Met Arg Leu Ala Glu Gly Pro Leu Met

165

170

175

Ser Pro Pro Arg Ser Tyr Met Glu Asp Met Thr Pro Thr Asn Val Tyr

180

185

190

Thr Glu Glu Glu Met Cys Tyr Glu Asp Met Ser Leu Trp Ser Tyr Arg

195

200

205

Tyr

<210> 17

<211> 1026

<212> DNA

<213> *Arabidopsis thaliana*

<400> 17

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gccactgtgt caggctcggg tactgcattt tctgatgaat ctgaagtttg tgcacgtgag 480
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gaagaacata acttggctgt tggttttgga attggacagg actcgaaaag ggagactttg 660
gatgcttggg tgatgggaaa tggcaatgaa caagaacat tggagtttgg tgtggatgaa 720
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1026

<210> 18

<211> 341

<212> PRT

<213> Arabidopsis thaliana

<400> 18

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1

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10

15

Asp Val Ala Glu Ile Leu Arg Gln Trp Arg Glu Tyr Asn Glu Gln Ile

20

25

30

Glu Ala Glu Ser Cys Ile Asp Gly Gly Gly Pro Lys Ser Ile Arg Lys

35

40

45

Pro Pro Pro Lys Gly Ser Arg Lys Gly Cys Met Lys Gly Lys Gly Gly

50

55

60

Pro Glu Asn Gly Ile Cys Asp Tyr Arg Gly Val Arg Gln Arg Arg Trp

65

70

75

80

Gly Lys Trp Val Ala Glu Ile Arg Glu Pro Asp Gly Gly Ala Arg Leu

85

90

95

Trp Leu Gly Thr Phe Ser Ser Ser Tyr Glu Ala Ala Leu Ala Tyr Asp

100

105

110

Glu Ala Ala Lys Ala Ile Tyr Gly Gln Ser Ala Arg Leu Asn Leu Pro

115

120

125

Glu Ile Thr Asn Arg Ser Ser Ser Thr Ala Ala Thr Ala Thr Val Ser

130	135	140
Gly Ser Val Thr Ala Phe Ser Asp Glu Ser Glu Val Cys Ala Arg Glu		
145	150	155 160
Asp Thr Asn Ala Ser Ser Gly Phe Gly Gln Val Lys Leu Glu Asp Cys		
	165	170 175
Ser Asp Glu Tyr Val Leu Leu Asp Ser Ser Gln Cys Ile Lys Glu Glu		
	180	185 190
Leu Lys Gly Lys Glu Glu Val Arg Glu Glu His Asn Leu Ala Val Gly		
	195	200 205
Phe Gly Ile Gly Gln Asp Ser Lys Arg Glu Thr Leu Asp Ala Trp Leu		
	210	215 220
Met Gly Asn Gly Asn Glu Gln Glu Pro Leu Glu Phe Gly Val Asp Glu		
225	230	235 240
Thr Phe Asp Ile Asn Glu Leu Leu Gly Ile Leu Asn Asp Asn Asn Val		
	245	250 255
Ser Gly Gln Glu Thr Met Gln Tyr Gln Val Asp Arg His Pro Asn Phe		
	260	265 270
Ser Tyr Gln Thr Gln Phe Pro Asn Ser Asn Leu Leu Gly Ser Leu Asn		
	275	280 285
Pro Met Glu Ile Ala Gln Pro Gly Val Asp Tyr Gly Cys Pro Tyr Val		
290	295	300

Gln Pro Ser Asp Met Glu Asn Tyr Gly Ile Asp Leu Asp His Arg Arg
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Phe Asn Asp Leu Asp Ile Gln Asp Leu Asp Phe Gly Gly Asp Lys Asp
 325 330 335

Val His Gly Ser Thr
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<210> 19

<211> 621

<212> DNA

<213> *Arabidopsis thaliana*

<400> 19

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<211> 206

<212> PRT

<213> Arabidopsis thaliana

<400> 20

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Gln Arg Thr Val Gln Ala Ser Ser Arg Lys Gly Cys Met Arg Gly Lys
20 25 30

Gly Gly Pro Asp Asn Ala Ser Cys Thr Tyr Lys Gly Val Arg Gln Arg
35 40 45

Thr Trp Gly Lys Trp Val Ala Glu Ile Arg Glu Pro Asn Arg Gly Ala
50 55 60

Arg Leu Trp Leu Gly Thr Phe Asp Thr Ser Arg Glu Ala Ala Leu Ala
65 70 75 80

Tyr Asp Ser Ala Ala Arg Lys Leu Tyr Gly Pro Glu Ala His Leu Asn
85 90 95

Leu Pro Glu Ser Leu Arg Ser Tyr Pro Lys Thr Ala Ser Ser Pro Ala
100 105 110

Ser Gln Thr Thr Pro Ser Ser Asn Thr Gly Gly Lys Ser Ser Ser Asp
115 120 125

Ser Glu Ser Pro Cys Ser Ser Asn Glu Met Ser Ser Cys Gly Arg Val

130

135

140

Thr Glu Glu Ile Ser Trp Glu His Ile Asn Val Asp Leu Pro Val Met

145

150

155

160

Asp Asp Ser Ser Ile Trp Glu Glu Ala Thr Met Ser Leu Gly Phe Pro

165

170

175

Trp Val His Glu Gly Asp Asn Asp Ile Ser Arg Phe Asp Thr Cys Ile

180

185

190

Ser Gly Gly Tyr Ser Asn Trp Asp Ser Phe His Ser Pro Leu

195

200

205

<210> 21

<211> 975

<212> DNA

<213> Arabidopsis thaliana

<400> 21

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<210> 22

<211> 244

<212> PRT

<213> Arabidopsis thaliana

<400> 22

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20 25 30

Leu Gln Arg Trp Glu Glu Glu Gly Leu Ala Arg Ala Arg Arg Val Gln
35 40 45

Ala Lys Gly Ser Lys Lys Gly Cys Met Arg Gly Lys Gly Gly Pro Glu
50 55 60

Asn Pro Val Cys Arg Phe Arg Gly Val Arg Gln Arg Val Trp Gly Lys
65 70 75 80

Trp Val Ala Glu Ile Arg Glu Pro Val Ser His Arg Gly Ala Asn Ser
85 90 95

Ser Arg Ser Lys Arg Leu Trp Leu Gly Thr Phe Ala Thr Ala Ala Glu
100 105 110

Ala Ala Leu Ala Tyr Asp Arg Ala Ala Ser Val Met Tyr Gly Pro Tyr
115 120 125

Ala Arg Leu Asn Phe Pro Glu Asp Leu Gly Gly Gly Arg Lys Lys Asp
130 135 140

Glu Glu Ala Glu Ser Ser Gly Gly Tyr Trp Leu Glu Thr Asn Lys Ala
145 150 155 160

Gly Asn Gly Val Ile Glu Thr Glu Gly Gly Lys Asp Tyr Val Val Tyr
165 170 175

Asn Glu Asp Ala Ile Glu Leu Gly His Asp Lys Thr Gln Asn Pro Met
180 185 190

Thr Asp Asn Glu Ile Val Asn Pro Ala Val Lys Ser Glu Glu Gly Tyr
195 200 205

Ser Tyr Asp Arg Phe Lys Leu Asp Asn Gly Leu Leu Tyr Asn Glu Pro
210 215 220

Gln Ser Ser Ser Tyr His Gln Gly Gly Gly Phe Asp Ser Tyr Phe Glu
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Tyr Phe Arg Phe

<210> 23

<211> 834

<212> DNA

<213> *Arabidopsis thaliana*

<400> 23

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gaagaaactg gaagtccttt cagaactgag aatttcagct gggataccct gatcgagatg 720
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<210> 24

<211> 277

<212> PRT

<213> *Arabidopsis thaliana*

<400> 24

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Gly Lys Gly Gly Pro Gln Asn Ala Leu Cys Gln Tyr Arg Gly Val Arg
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Gln Arg Thr Trp Gly Lys Trp Val Ala Glu Ile Arg Glu Pro Lys Lys
35 40 45

Arg Ala Arg Leu Trp Leu Gly Ser Phe Ala Thr Ala Glu Glu Ala Ala
50 55 60

Met Ala Tyr Asp Glu Ala Ala Leu Lys Leu Tyr Gly His Asp Ala Tyr
65 70 75 80

Leu Asn Leu Pro His Leu Gln Arg Asn Thr Arg Pro Ser Leu Ser Asn
85 90 95

Ser Gln Arg Phe Lys Trp Val Pro Ser Arg Lys Phe Ile Ser Met Phe
100 105 110

Pro Ser Cys Gly Met Leu Asn Val Asn Ala Gln Pro Ser Val His Ile
115 120 125

Ile Gln Gln Arg Leu Glu Glu Leu Lys Lys Thr Gly Leu Leu Ser Gln
130 135 140

Ser Tyr Ser Ser Ser Ser Ser Ser Thr Glu Ser Lys Thr Asn Thr Ser
145 150 155 160

Phe Leu Asp Glu Lys Thr Ser Lys Gly Glu Thr Asp Asn Met Phe Glu
165 170 175

Gly Gly Asp Gln Lys Lys Pro Glu Ile Asp Leu Thr Glu Phe Leu Gln
180 185 190

Gln Leu Gly Ile Leu Lys Asp Glu Asn Glu Ala Glu Pro Ser Glu Val
195 200 205

Ala Glu Cys His Ser Pro Pro Pro Trp Asn Glu Gln Glu Glu Thr Gly
210 215 220

Ser Pro Phe Arg Thr Glu Asn Phe Ser Trp Asp Thr Leu Ile Glu Met
225 230 235 240

Pro Arg Ser Glu Thr Thr Thr Met Gln Phe Asp Ser Ser Asn Phe Gly
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Ser Tyr Asp Phe Glu Asp Asp Val Ser Phe Pro Ser Ile Trp Asp Tyr
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Tyr Gly Ser Leu Asp
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<210> 25

<211> 924

<212> DNA

<213> Arabidopsis thaliana

<400> 25

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acttggggta aatgggtggc tgagatccgt gagcctaacc gtgggactcg tctctggctc 180
 ggcacgttta atacctcggc cgaggccgcc atggcttacg atgaagccgc taagaaactc 240
 tatggacacg aggctaaact caacttgggtg caccacaac aacaacaaca agtagtagtg 300
 aacagaaact tgtctttttc tggccacggg tcgggttctt gggcttataa taagaagctc 360
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 ggatcgtcgg acaacaagga gagtatgttg gttcctagtt gcggcggaga gaggatgcat 780
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<210> 26

<211> 306

<212> PRT

<213> Arabidopsis thaliana

<400> 26

Glu Glu Glu Gln Pro Pro Ala Lys Lys Arg Asn Met Gly Arg Ser Arg

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10

15

Lys Gly Cys Met Lys Gly Lys Gly Gly Pro Glu Asn Ala Thr Cys Thr

20

25

30

Phe Arg Gly Val Arg Gln Arg Thr Trp Gly Lys Trp Val Ala Glu Ile

35

40

45

Arg Glu Pro Asn Arg Gly Thr Arg Leu Trp Leu Gly Thr Phe Asn Thr

50	55	60
Ser Val Glu Ala Ala Met Ala Tyr Asp Glu Ala Ala Lys Lys Leu Tyr		
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Gly His Glu Ala Lys Leu Asn Leu Val His Pro Gln Gln Gln Gln Gln		
85	90	95
Val Val Val Asn Arg Asn Leu Ser Phe Ser Gly His Gly Ser Gly Ser		
100	105	110
Trp Ala Tyr Asn Lys Lys Leu Asp Met Val His Gly Leu Asp Leu Gly		
115	120	125
Leu Gly Gln Ala Ser Cys Ser Arg Gly Ser Cys Ser Glu Arg Ser Ser		
130	135	140
Phe Leu Gln Glu Asp Asp Asp His Ser His Asn Arg Cys Ser Ser Ser		
145	150	155 160
Ser Gly Ser Asn Leu Cys Trp Leu Leu Pro Lys Gln Ser Asp Ser Gln		
165	170	175
Asp Gln Glu Thr Val Asn Ala Thr Thr Ser Tyr Gly Gly Glu Gly Gly		
180	185	190
Gly Gly Ser Thr Leu Thr Phe Ser Thr Asn Leu Lys Pro Lys Asn Leu		
195	200	205
Met Ser Gln Asn Tyr Gly Leu Tyr Asn Gly Ala Trp Ser Arg Phe Leu		
210	215	220

Val Gly Gln Glu Lys Lys Thr Glu His Asp Val Ser Ser Ser Cys Gly
 225 230 235 240

Ser Ser Asp Asn Lys Glu Ser Met Leu Val Pro Ser Cys Gly Gly Glu
 245 250 255

Arg Met His Arg Pro Glu Leu Glu Glu Arg Thr Gly Tyr Leu Glu Met
 260 265 270

Asp Asp Leu Leu Glu Ile Asp Asp Leu Gly Leu Leu Ile Gly Lys Asn
 275 280 285

Gly Asp Phe Lys Asn Trp Cys Cys Glu Glu Phe Gln His Pro Trp Asn
 290 295 300

Trp Phe
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<210> 27

<211> 534

<212> DNA

<213> Arabidopsis thaliana

<400> 27

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 aatcttccac tgctgccact gtgtcaggct cggttactgc attttctgat gaatctgaag 420
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<210> 28

<211> 177

<212> PRT

<213> Arabidopsis thaliana

<400> 28

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Leu Arg Lys Trp Arg Glu Tyr Asn Glu Gln Thr Glu Ala Asp Ser Cys
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Ile Asp Gly Gly Gly Ser Lys Pro Ile Arg Lys Ala Pro Pro Lys Arg
 35 40 45

Ser Arg Lys Gly Cys Met Lys Gly Lys Gly Gly Pro Glu Asn Gly Ile
 50 55 60

Cys Asp Tyr Thr Gly Val Arg Gln Arg Thr Trp Gly Lys Trp Val Ala
 65 70 75 80

Glu Ile Arg Glu Pro Gly Arg Gly Ala Lys Leu Trp Leu Gly Thr Phe
 85 90 95

Ser Ser Ser Tyr Glu Ala Ala Leu Ala Tyr Asp Glu Ala Ser Lys Ala

100	105	110
Ile Tyr Gly Gln Ser Ala Arg Leu Asn Leu Pro Leu Leu Pro Leu Cys		
115	120	125
Gln Ala Arg Leu Leu His Phe Leu Met Asn Leu Lys Phe Val His Val		
130	135	140
Arg Ile Gln Met Gln Asp Leu Val Leu Val Arg Ser Leu Thr Ser Arg		
145	150	155
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Ile Ser Lys Met Leu Ser Pro Ile Thr Ala Leu Val Lys Leu Gly Arg		
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Tyr

<210> 29

<211> 18

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Primer

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18

<210> 30

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 30

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18